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Project Type: Research and Development

Title: Monitoring Populations of Aphids and Leafhoppers in Snap Bean Fields in Western New York.

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Type of Grant: Monitoring, forecasting and economic thresholds

Project Location: Western New York

Abstract: Viruses transmitted by aphids caused great devastation in many snap beans in western New York in 2001. In 2002, viruses were detected again in snap bean fields, but there was little affect o yield. The main goal of this project is to continue to obtain a better understanding of the pest pressure and geographical distribution of aphids over the growing season through monitoring and networking techniques. This project involved monitoring in-field populations of aphids and leafhoppers throughout the season and evaluated the efficacy of the commercial application of Gaucho seed treatment to control aphids and leafhoppers in snap bean fields throughout western NY.

Background and Justification:

In 2001, black bean aphid (BBA, *Aphis fabae* Scopoli) pressure was severe in western New York. Within less than a week in late June, snap bean fields were infested with as many as 120 aphids per trifoliate leaf per plant, with younger plants being more severely infested. The BBA may have been responsible for the transmission of several viruses including cucumber mosaic virus (CMV), alfalfa mosaic virus (AMV), and several potyviruses such as bean common mosaic virus (BCMV) and bean yellow mosaic virus (BYMV). CMV was the most prevalent of the viruses diagnosed, however, several samples were diagnosed with more than one virus per plant.

Unlike 2001, the mass colonization of snap beans by black bean aphids or other species did not occur in 2002. Perhaps the cool wet spring appeared to be unfavorable for aphid populations to build. In 2002 the black bean aphid was one of many aphid species captured in water pan traps and found on plants in snap bean fields. Weekly monitoring showed that trap catches peaked in early August for Chautauqua, Niagara, Genesee, and two weeks later in East Orleans. Highest water pan catches occurred in Niagara and Orleans. Field infestation reflects the trap catches with the exception of Chautauqua. Aphid populations increased again in September in Niagara and Orleans counties. There did not appear to be any major movements of aphids between snap bean fields and alfalfa fields, soybean fields and wooded areas.

The Important of Season Long Monitoring:

Aphid species naturally occur in North America and can be found from New Brunswick to Florida and westward to California. Infestations are generally localized and natural enemies including ladybird beetles, lacewings, Syrphid flies and Cecidomyiids usually keep populations in check. In the spring, these eggs hatch into wingless, parthogenetic females that give birth to similar individuals. After a few generations winged forms appear and fly to summer hosts including several vegetable, agronomic, fruit and ornamental crops as well as several weeds. Repeated generations occur throughout the summer. Feeding and reproduction increase with warm weather. Winged forms appear with cool fall weather and they fly to their winter hosts where sexual reproduction and egg-laying occurs.

The pest pressure, movement and distribution of aphids in NY need to be determined in order to use control options as effectively as possible. CMV, AMV, BCMV and BYMV are all viruses, which are vectored in a non-persistent manner by many species of aphids. An aphid carrying a virus merely needs to probe a plant to cause an infection, although efficiency of transmission may vary for a number of reasons. Primary spread of viruses occurs when the crop is initially infected by winged adults that disperse into the field, while secondary spread occurs when the viral infection is spread by aphids within the crop.

Potato leafhoppers (PLH) are another pest, which has the potential to devastate a snap bean crop. Potato leafhoppers are a migratory pest, coming from over wintering sites in the Gulf States and appear in NY as early as late May to early June. Potato leafhoppers are sucking insects and both nymphs and adults remove plant sap directly from the vascular system in the leaf. If infestations occur at an early plant growth stage, stunting and decreased yields may result. Infestations occurring after bloom usually do not affect yields.

In 2002, Gaucho (imidacloprid) commercial seed treatment was applied to snap bean seed to reduce the population of aphids on plants and to reduce secondary spread of viruses within each field. Gaucho seed treatment was also applied to the seed as a line defense against infestations of leafhopper at early growth stages of snap beans. Efficacy of Gaucho has primarily been assessed on a small plot basis. Growers are interested in systemic seed treatments for insect control when plants are at early growth stages since it is very inefficient to apply foliar insecticides when plants are so small.

Objectives:

1) To intensively monitor season-long pest pressure and movement of aphids at four sites in western New York.
2) Evaluate Gaucho treated versus No Gaucho treated fields for aphids and leafhopper control on a commercial field size evaluation in snap bean fields.

3) To maintain a network to monitor the distribution of aphids in western New York.

Procedures:

Monitoring Pest Pressure and Movement: Since many aphid species are capable of transmitting viruses, all aphid species captured were monitored. Potato leafhopper (PLH) adults and nymphs were monitored.

Field Locations. To monitor season-long aphid activity in western New York, early and late planted fields were selected in each of Niagara, Orleans, Genesee (Central) and southern Genesee Counties. Of these 4 locations, field numbers 1, 3, 5, 6, 7, 8, 10, 12 (Appendix 1) overlapped with the study, Evaluating Seasonal Patterns of Aphid Movement and Virus Incidence in Snap Bean Fields by Nault et al. To monitor the movement of aphids into snap beans where growers planted Gaucho treated seed and No Gaucho treated seed, four additional late fields planted 7/22,-7/26 (#13-18) were selected in Marshall Rd, Angling Road and York Road Genesee County. In total, 14 snap bean plantings were selected from 3 counties of which 4 fields were adjacent to alfalfa, 10 fields were "isolated" from alfalfa or other legume crops. Overall, this study is representative of the 9,500 acres of processing snap beans grown in these 3 counties in western NY. See Appendix I for a list of the field sites and characteristics.

Aphid Monitoring with Water Pan Traps: Water pan traps, designed by Nault et al. and Dave Ragsdale, University of Minnesota were used to monitor aphids in this study. The trap frame consisted of a tomato plant supporter with the bottom ring cut off leaving legs to penetrate the ground about 8 inches with the top ring holding a quart-sized Rubbermaid container. Within the container was a 4 1/4-inch piece of ceramic tile with a mottled green surface. Containers were filled about 1 inch deep with 20% glycol solution. Three traps were placed within the plant row in the border row of snap bean, and adjacent alfalfa fields. In the field sites that were in common with the Nault et al study, a total of 12 traps were used with 3 located in the border row of the adjacent alfalfa, 3 in the snap bean border row, 3 in the center of the snap bean field and 3 on the far side of the snap bean field. Where snap bean fields were "isolated" (> 3 miles of an alfalfa field), no traps were set up in an adjacent field. Trap catches were collected once weekly. Winged aphids were removed and the glycol solution reused. Collected winged aphids were sent to Dr. R. V. Eckel for identification in those fields comparing Gaucho and No Gaucho seed treatments. All other locations were identified by Dr. R.V. Eckel for the Nault et al. study and are not included in this report.

Gaucho-No Gaucho Seed Treatment Comparison

As it turned out few growers used Gaucho treated seed in early and late-planted fields. To get a comparison of seed treatments, 2x20 foot rows of Gaucho treated seed were planted by the researcher in the adjacent row between water pan traps. Once fields were identified with Nault et al, the researcher planted the Gaucho treated strips in early and late-planted fields. Some fields were cultivated, given the wet season; hence these fields were removed as a comparison from the study. Three additional late-planted locations (13,14,15,16,17,18) were identified for a direct comparison of seed treatments. Two locations, Marshall Road and York Road were planted the same day with Gaucho treated seed on one side of the field and no Gaucho treated seed on the other. The third location for comparison was at Angling Road where

two fields (one Gaucho and one No Gaucho) were planted 2 days apart within a mile of each other (#17, 18 Appendix 1). In these locations, 3 water pan traps were located in the border of the field and 3 water pan traps were located at the center of the snap bean field.

In-Field Monitoring of Aphids and Potato Leafhoppers: On the same day as the trap catches were collected, a field scout visually examined the 3 youngest trifoliates of 60 plants (10 plants x 6 sites) per field and per strips. All plant count data is reported on a per leaflet basis. For example, 120 leaflets (6 sites x 10 plants x 2 leaves) were sampled when plants were at the 2 leaf stage of growth, 180 leaflets (6 sites x10 plants x 3 leaflets) at the 1st trifoliate and 540 leaflets for plants with 3 or more trifoliate leaves per treatment. Live winged and wingless aphids including immature nymphs were recorded in the field (no Gaucho) and planted strips Gaucho. In addition, the field scout visually examined mature trifoliate leaflets for the presence of potato leafhopper nymphs and adults.

Data Analysis: Data was analyzed by ANOVA and the mean cumulative number of winged aphids captured per trap over the cropping season was compared between different geographic locations. The mean cumulative number of PLH Adults and Nymphs were compared after emergence for 4 weeks to compare Gaucho/ No Gaucho seed treatments. Comparison of Gaucho/No Gaucho for PLH adults and nymphs will be focussed on in early-planted fields (1,3,4,5,6). Gaucho treated seed was planted after fields were identified for Nault et al's project. Gaucho treated test strips were similar in maturity to the field and will be used to compare seed treatments for PLH adult and nymph control. Aphid pressure was too low to make a comparison in these fields. In late-planted fields, Gaucho treated strips were delayed 10-14 days in plant development. This was too great a maturity difference to make any good unbiased comparisons between treatments.

Weather Monitoring: Weather data including accumulated growing degree days (base 50) rainfall and rain events over ½ inch will be included in this report since aphid populations can be influenced by these factors.

2) Network to Alert Industry of Aphid Pressure:
An informal network was set up by the members of the Lake Plains Vegetable Program (LPVP) with fieldmen, private consultants, field scouts and extension educators working with snap beans to report any incidents of aphids and viruses. All such reports were made available through the LPVP *PestMinder* and other similar weekly publications.

Results and Discussion:

Figure 1a: Growing Degree Days Base 50 within LPVP for 2000-2003.

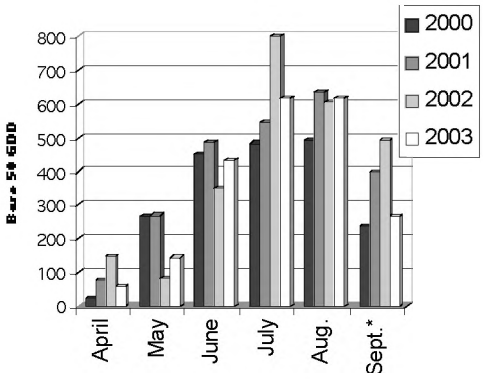
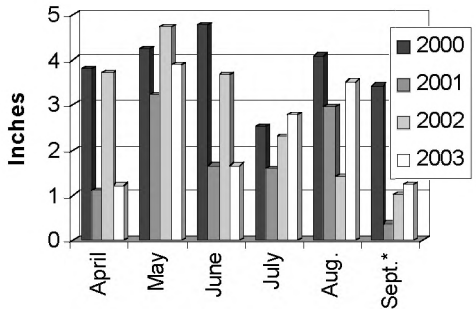


Figure 1b Average Monthly Rainfall for LPVP 2000-2003.



Weather: The North East Weather Association weather stations recorded rainfall and accumulated heat units throughout the LPVP region including those fields surveyed. Accumulated Heat Units: Within the main snap bean growing season of July, August and September, rainfall patterns were isolated and cloudy conditions persisted. Similarities in spring weather between 2001 and 2003 and which differed from 2002 may help to explain why aphid populations increased in snap beans in 2002 and 2003 and not 2001. Aphids are expected to thrive under dry conditions. In 2001 and 2003 there were similar accumulated heat units in April June July August (Fig 1a). May was slightly warmer in 2003 than 2002 but was way below 2001 for accumulated heat. July, August and September were similar in accumulated heat units while August 2002 was the driest in the last four years. Cooler weather in May and June may have prevented populations from increasing at a rapid rate early in the season as in 2001. Accumulated-Rainfall**:** Considerably more rainfall was received in 2003 with April: x"; May: y"; June: z" which was similar to rainfall in 2001 (April: 1.1"; May: 3.2"; June: 3.7") but both years considerably lower than 2002 in April (3.7"), May (4.7") and June (3.7") when aphid populations were low.

Heavy Rain Events can also help minimize the growth in aphid populations early in the season. Showers occurred in May and early June. Main rainfall events occurring over a ½ inch which can be an indicator of heavy rainfall are listed in (table2). Two North East Weather Association weather stations (Knowsville & Pavilion) provide rainfall data. At the Knowsville weather station in Orleans there was rainfall recorded over ½" from 5/24-7/10 (47 days) and 7/16-8/2 (16 days), 8/3 to 8/29 (26 days). At the Pavilion weather station in Genesee no rainfall greater than .5" was recorded from 5/31 – 7/21 (51 days) and from 7/24-8/29 (36 days). Despite the rain events throughout the season, aphid populations continued to increase. In conjunction with June, July, and August accumulated heat unites combined with more frequent rainfall in 2003, helped prevent populations from increasing and may explain why we did not see an aphid population explosion within the area in 2003 as seen in 2001.

Aphid Species Identified. In 2003, there were significant aphid populations present throughout western NY. Snap bean virus symptoms were visual in many fields in late-planted fields. Aphids identified for all the fields in common with Nault et al (fields 1-12). The pea aphid, *Acyrthosiphon pisum,* was the most abundant species in early-planted fields, whereas the soybean aphid, *Aphis glycines*, was the most abundant in late-planted fields.

Aphid Pressure (Figure 4): Overall densities of aphids colonizing snap bean plants were very low until the 1st 2 weeks of August and did not reach populations as high as 2001. For example, in 2001 there were as many as 40 black bean aphids per plant during the cotyledon stage, in 2002, there were just over 3 aphids on a trifoliate leaf 7/29/02 and 14 was the highest number reported on a trifoliate in 2003. Aphid nymphs were found on snap bean plants in 2001 and 2003 but were not found on plants in 2002. Winged and wingless aphids increased and decreased over the same weekly period. Suggesting that aphids may have been birthing nymphs however these nymphs were not surviving. Soybean aphids nymphs have not been found to survive past the 2nd instar (Dave Hogg University of Wisconsin 2001). Aphids killed by a fungal disease were observed in late-planted fields. (Aphids were not sampled specifically for fungus in the survey however in the neighboring Finger Lakes Cornell researchers found several epizootics.)

Season Long Monitoring

Aphids in Water Pan Traps (Figure 3): In 2003 water pan trap catches were low in the early-planted fields. The first trap counts were recorded in early planted fields 6/16. Trap catches increased over time and peaked in all but the Orleans location 7/28 in early planted snap bean fields just prior to harvest. In late- planted fields, aphid trap catches remained under 10 aphids/trap in all 4 locations from 8/4 to 8/18. Aphid flights into snap bean fields peaked in water pan traps 8/25 with 50 aphids/trap in Orleans and 21 aphids/trap in Niagara County. In Genesee (Central) and Genesee, aphid flights into snap bean fields peaked 1 week later with 35 aphids/trap and 22 aphids/trap. The highest flights of aphids into early snap bean fields were in Genesee County near Batavia. The highest flights of aphids into snap bean fields were in late planted snap bean fields in Orleans County (Angling Rd).

Aphids on Plants (Figure 4): Winged and wingless aphids were monitored throughout the growing stages in early and late-planted snap bean fields. Overall there is a similar trend over time with plant count data and water pan data. Early planted fields had very low winged and wingless counts per leaflet. Over all the locations, sum of the average winged aphids per leaflet was 0.1 for early-planted fields and 0.43 for late-planted fields (Table 3). For wingless aphids, the sum of the average wingless aphids per leaflet was 0.01 per leaflet for early plantings and 0.41 for late plantings. Since winged and wingless aphids counts per leaflet were very close (0.02) would suggest that insecticide applications were reducing both winged and wingless populations. In addition, the wingless aphids were not successfully reproducing on snap bean fields. It would be expected that if wingless soybean aphid populations were increasing there would be a larger difference between the winged and wingless per leaflet counts.

Potato Leafhopper (PLH) Adults and Nymphs (Figure 5): PLH adult and nymph populations varied throughout western NY. In early-planted snap bean fields adjacent to alfalfa (Niagara, Orleans, and Genesee) populations of PLH increase the following week. Highest per leaflet counts of adult PLH was 6/30 at 0.28 adults per leaflet in Niagara. A foliar spray application was made at this point by the grower. Nymph counts reached 0.06 nymphs per leaflet the following week 7/7 before declining further after a second foliar insecticide application. One field had no foliar spray applied throughout the season. Given the wet compacted planting conditions, the grower decided not to invest any more money into the field. Highest adult counts were 6/30 with 0.2 Adults per leaflet. These declined over time to less than 0.05 by harvest.

Nymph populations increased over the growing period to 0.46 nymphs per leaflet 7/21 two weeks prior to harvest.

Gaucho No Gaucho Seed Treatment Analysis

Potato Leafhopper Nymphs and Adults (Figure 5): Genesee (Central) (Figure 5 Genesee (Central) Early Planting) had no foliar insecticide applied and is representative of how PLH growth and activity occurs in the field with no foliar insecticide management. At this location adults per leaflet declined 50 percent per week from 0.20 / leaflet (6/6), to 0.10 / leaflet (7/7), to 0.05 / leaflet (7/14) while adults increase slightly from 0.06-0.09 / leaflet in the No Gaucho field over the same period. Nymphs continued to increase over the same period and peaked 7/21 at 0.46 / leaflet with No Gaucho compared to 0.35 / leaflet with Gaucho treated seed.

All of the early-planted snap bean fields over 6/23-7/21 were then used to assess the efficacy of Gaucho compared to No Gaucho seed treatments (Table 4). In all three of the fields a foliar application was made 7/14. There were no significant differences between the Gaucho and No Gaucho treatments for nymphs and adults. Nymphs were reduced 31 percent from 0.24 / leaflet No Gaucho compared to 0.16 / leaflet Gaucho. Adult PLH per leaflets increased 19 percent from 0.26 / leaflet No Gaucho to 0.31 / leaflet Gaucho. A possible explanation for this increase is that Gaucho reduces the activity of the adults and makes them "drunk" or "lazy" and less flighty. Consequently, they were easier to count and did not fly off the plants when scouting the field.

Winged and Wingless Aphids (Figure 6): Three locations Angling Rd., Marshall Rd, and York Rd. were used to evaluate winged and wingless aphids on plants where Gaucho and No Gaucho was applied to the seed. These were planted from 7/22 to 7/26 and were some of the latest plantings for the year. Figure 6 water pan data shows that winged and wingless aphid entered the fields early on over the same period 8/18 to 9/1 at similar rates. Average accumulated winged and wingless aphids were compared for Gaucho and No Gaucho seed treatments (Table 6). No statistical differences or numerical differences were found between the Gaucho and No Gaucho treatments over the period 8/4-9/1. Aphid populations were reduced on plants after foliar insecticides were applied. *Note: In two late planted fields where Gaucho strips were planted and were behind 14 days than the No Gaucho field, counts of both winged and wingless aphids were* 4 times as high.

Aphid Species Identified in Angling Rd., Marshall Rd, and York Rd.

Thirty-five species of aphids were identified in these fields. Soybean aphids, *Aphis glycines* (66 percent) was the predominant species followed by corn leaf aphid *Rhopalosiphum maidis* (17 percent) cowpea *Aphis craccivora* (2 percent), Yellow clover aphid *Therioaphis trifolii* (1.6 percent), and green peach *Myzus persicae* (1 percent). Marshall road just north of the Erie Canal had the highest number of aphids in water pan traps with 100 per trap over the season with 64% soybean aphid. Angling road north of 104 had 92.9 aphids per trap over the season with 69% soybean aphids. At York road (southern Genesee) 58.2 aphids were trapped over the season with 57% of the total comprising of soybean aphids. There is no indication other than possibly rainfall differences in these geographical areas that would suggest the slight differences in populations. Marshall road was adjacent to a soybean field, which would suggest higher soybean aphid populations. In 2002 soybean fields adjacent to snap bean fields and alfalfa fields adjacent to snap bean fields were compared to isolated fields and there were no differences in

aphid movement into these fields given the proximity of these fields. In addition, Nault et al in 2003 did not find any significant differences in aphid populations in snap bean fields given their close approximation to alfalfa fields.

Virus Analysis

Since virus symptoms were visible in these late-planted fields, plant samples were collected from Marshall Rd and York Rd. Fifteen samples (5 plants X 3 locations) were collected from the Gaucho and No Gaucho areas of the field totaling 30 samples per location. Samples were tested for CMV, AMV, TSV, and POTY. At Marshall Rd, samples tested positive 100 % CMV and 0 for AMV, TSV, and POTY for seed treated with either Gaucho or No Gaucho. At York Rd, samples tested positive 100% for CMV, 27% for AMV in Gaucho treated seed and 33% AMV in No Gaucho treated seed, 0 for TSV and POTY. These high incidences may be because high aphid populations colonized snap bean plants at cotoledon and two true leave stages of growth.

Beneficial Insects: Ladybird beetles and lacewings were observed in fields where aphids were present approximately 2 weeks after populations peaked in late planted fields.

Conclusions:

Aphid populations were low in early-planted snap bean fields and started to increase 7/28. In late planted fields weekly water pan trap monitoring indicated aphid flights into snap bean increasing slowly from 8/4 to 8/18 and increasing rapidly until peaking 9/1. A majority of these aphids were soybean aphids. PLH pressure was high in early-planted fields compared to late-planted fields. Highest per leaflet counts of adult PLH was June 30th at 0.28 adults per leaflet. PLH adult pressure increased in snap bean fields a week following an adjacent alfalfa field that was harvested. PLH nymphs did not increase significantly since foliar insecticides were applied. Where no insecticide was applied, nymphs increased up to 0.46 / leaflet.

There were no significant differences between Gaucho and No Gaucho treated seed for control of PLH nymphs or adults. Nymphs were reduced 31 percent from 0.24 / leaflet No Gaucho compared to 0.16 / leaflet Gaucho. Adult PLH per leaflets increased 19 percent from 0.26 / leaflet No Gaucho to 0.31 / leaflet Gaucho. A possible explanation for this increase is that Gaucho reduces the activity of the adults and makes them “drunk” or “lazy” and less flighty. Consequently, they were easier to count and did not fly off the plants when scouting the field. There were no significant differences between Gaucho and No Gaucho treated seed for control of winged aphids and wingless aphids and very little numerical differences. Similarly, there were no differences in the percentage of plants infected with viruses such as CMV in Gaucho and No Gaucho treated areas.

There were 35 aphid species identified in late-planted snap bean fields. The most common aphid species was the soybean aphid with a minimum of 57 and maximum of 69 percent of the accumulated total counts in water pan traps. Wingless aphid populations did not increase on plants, which would confirm that soybean aphids do not complete their life cycle on snap beans. Even with seed treatments and two foliar spray applications, there was 100 infection of CMV in fields tested for virus suggesting that the use of chemicals to control aphids to control virus is ineffective. Surprisingly, where Gaucho strips were planted and were behind 14 days than the field, counts of both winged and wingless aphids were 4 times as high on these snap bean plants than in the adjacent field row.

Further Research:
1/ Aphids were attracted to snap bean plants that were delayed in maturity 14 days compared to the rest of the field. Possibly, this could be capitalized on to act as a trap crop for aphids entering snap bean fields.
2/ Virus incidence was very high where aphids dispersed into fields at early stages of growth. We do not know the impact of when aphid flights disperse into fields at different stages of growth and how this affects virus incidence and its potential impact on yield and snap bean quality.

Acknowledgements:
This research project was partially funded by the New York Crop Research Association and the New York Integrated Pest Management Program.

References:

Dave Hogg 2001 Presentation at the Wisconsin Processor Grower Meeting Madison Wisconsin.

Brian Nault, Dennis Shah, Arlie McFaul Quantifying the Temporal Dynamics of Aphid Movement and Virus Spread in Snap Bean Fields. 2003 Report for the New York State Crop Research Association.

List of Tables

Table 2 Rainfall over ½ Inch Recorded at Knowsville and Pavilion North East Weather Association Sites.

Date	Orleans	Genesee	Date	Orleans	Genesee
5/11	0.6	0.6	8/2	0.6	
5/16	0.7	0.7	8/3	1.1	
5/20	0.6		8/29	1.0	0.5
5/24	0.5		8/30		0.6
5/31		0.8	9/2		0.6
7/10	0.6		9/15	1.1	
7/16	0.5		9/16		1.2
7/21		0.5	9/22	0.6	
7/23		0.7	9/27	0.5	
7/24		0.5			
Total Rainfall including<0.5 inches				**15.98**	**15.43**

Table 3: Average Cumulative Number of Winged and Wingless Aphids per Trifoliate Leaflet per Week in Early and Late Planted Snap Beans by area in Western New York 2003.

County	Winged Aphids/Week		Wingless Aphids/Week	
Early Planted	No Gaucho	Gaucho[1]	No Gaucho	Gaucho[1]
Niagara	0.02	0.02	0.00	0.00
Orleans	0.01	0.01	0.00	0.00
Genesee (Central)	0.05	0.03	0.00	0.00
Genesee	0.02	0.01	0.01	0.00
Total	**0.10**	**0.07**	**0.01**	**0.00**
Late Planted				
Niagara	0.09	0.36	0.12	0.44
Orleans	0.12	0.19	0.14	0.43
Genesee (Central)	0.14	0.09	0.10	0.07
Genesee	0.08	0.23	0.05	0.25
Total	**0.43**	**0.87**	**0.41**	**1.19**

[1/]Guacho treated seed in these fields were 1-2 weeks behind the field (No Gaucho) in stage of growth consequently acting as an attractant. Where No Gaucho and Gaucho seed treatments were planted the same day, there were no numerical differences of aphids/trifoliate leaflet.

Table 4: Comparison of Gaucho and No Gaucho Treated Seed for Average Cumulative Number of PLH Adults and Nymphs per Trifoliate Leaflet per Week in Early Planted Snap Bean Fields in Western NY for the Period 6/23-7/21.

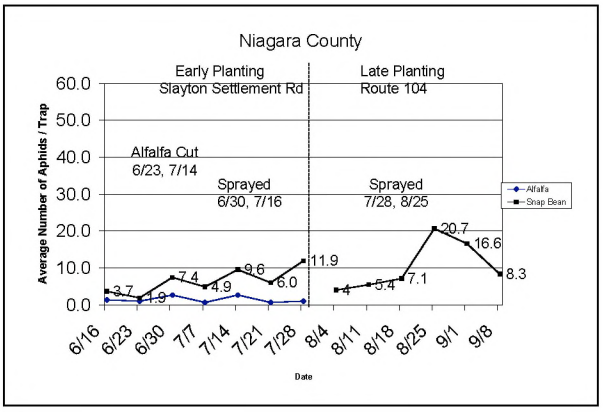
	Sample	PLH-Nymphs	PLH-Adults
Gaucho	N=4	0.1652	0.316
No Gaucho	N=4	0.2405	0.2654
P value		NS[1]	NS[1]

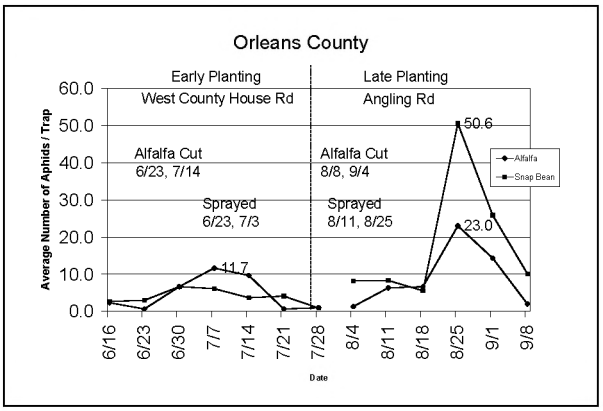
[1]NS: not significant according to Fisher's Protected LSD test ($p>0.05$).

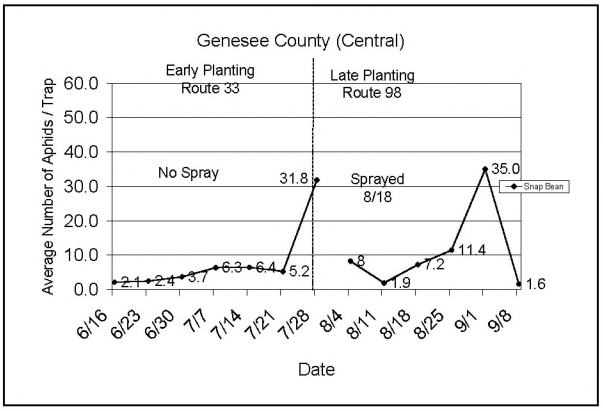
Table 6: Comparison of Aphids on Plants in Gaucho and No Gaucho treated seed fields in Angling Rd, Marshall Rd and York Rd.

	Sample	Wingless	Winged
Gaucho	n=3	0.1326	0.136
No Gaucho	n=3	0.1250	0.11
P value		NS[1]	NS[1]

Figure 3: Season Long Monitoring of Aphids per Water Pan Trap By County in Early and Late Planted Snap Bean







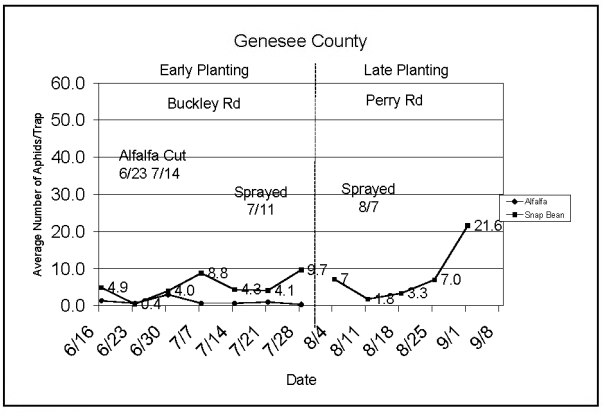
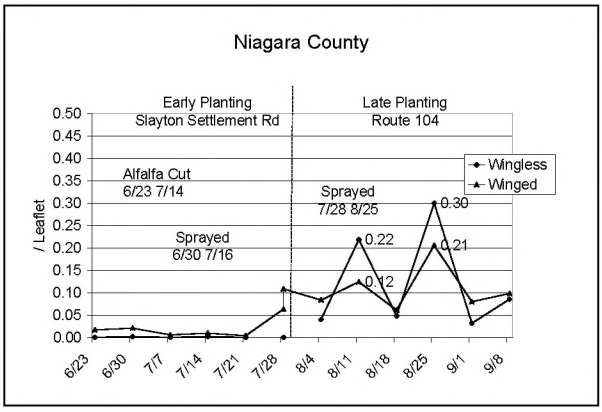
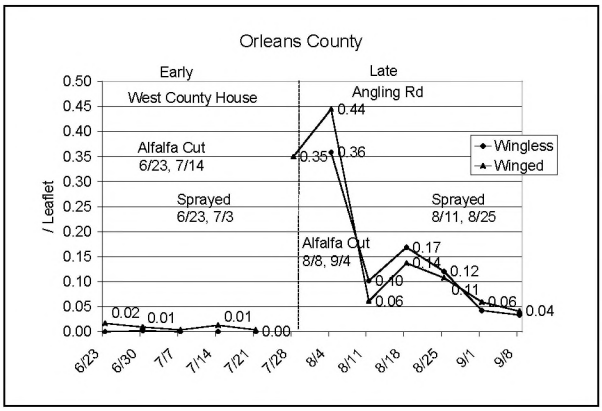
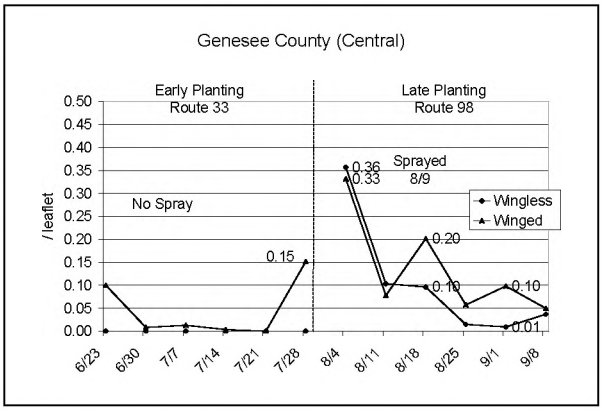


Figure 4: Season Long Monitoring of Winged and Wingless Aphids per Trifoliate Leaflet by County in Early and Late Planted Snap Bean Fields.







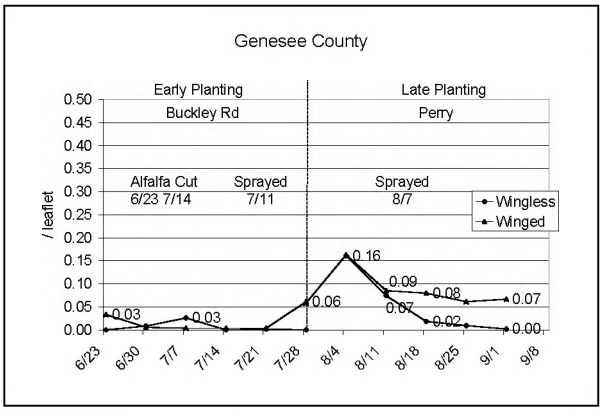
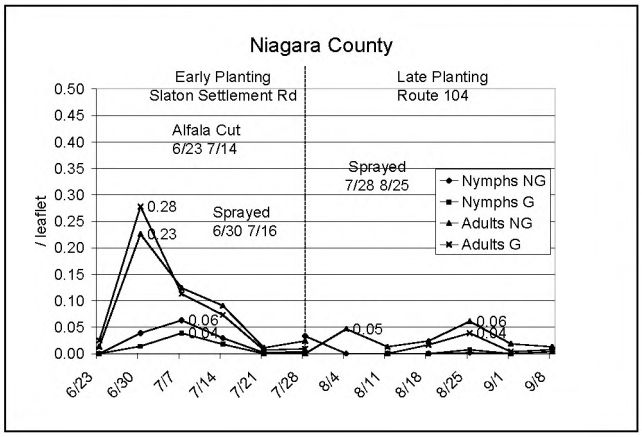
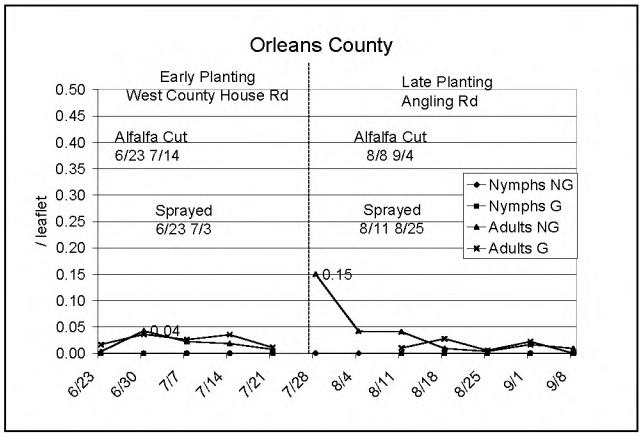
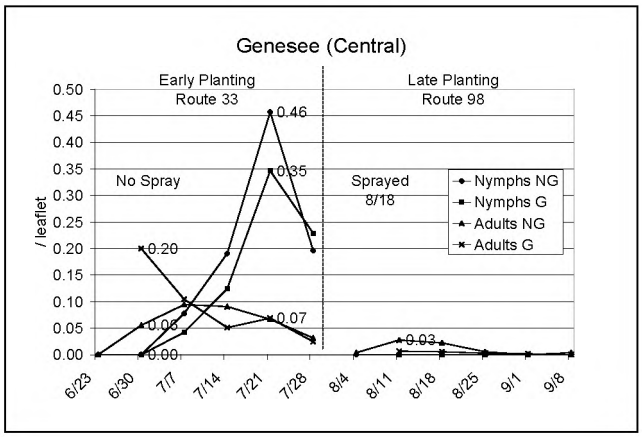
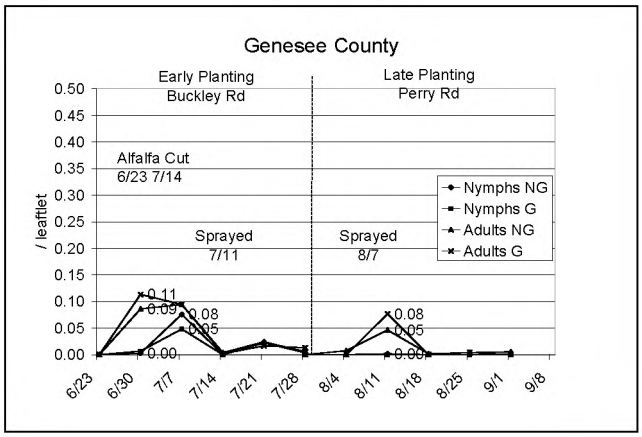


Figure 5: Seasonal Monitoring of Potato Leafhopper Adults and Nymphs per Trifoliate Leaflet on Early and Late Planted Fields in 4 Locations in Western NY.





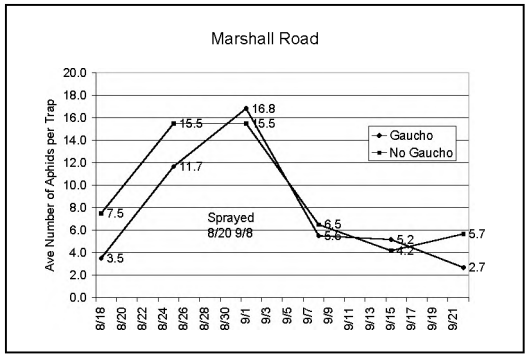


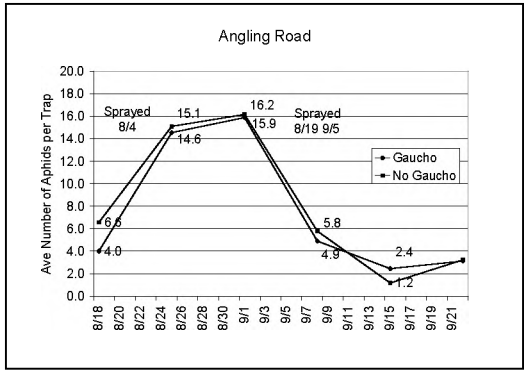


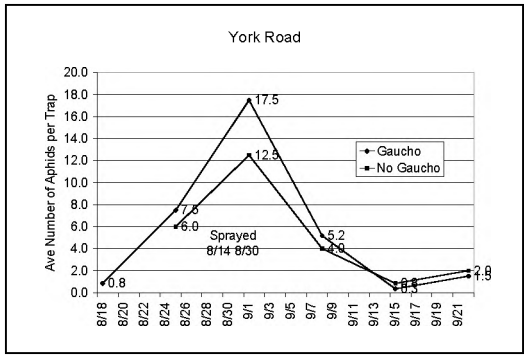
Note:
NG – No Gaucho seed treatment
G – Gaucho seed treatment

Figure 6: Aphid Monitoring in Three Locations for Gaucho and No Gaucho Seed Treatment Fields.

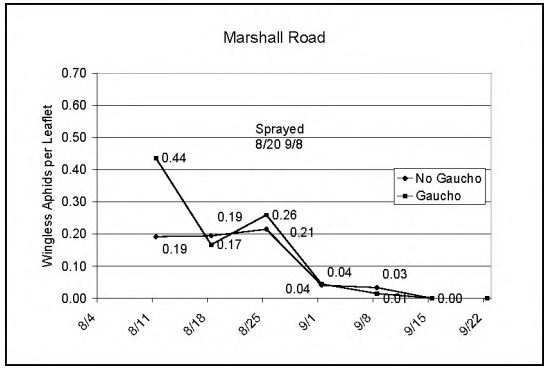
Winged Aphids / Water Pan Trap

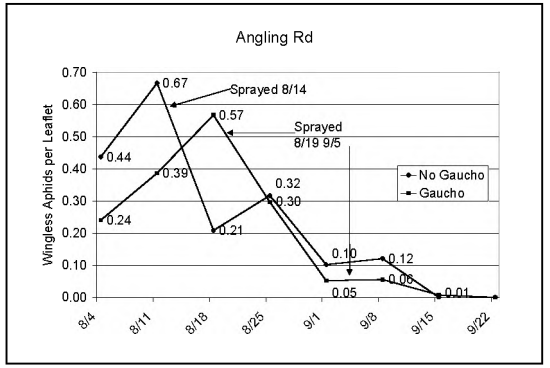


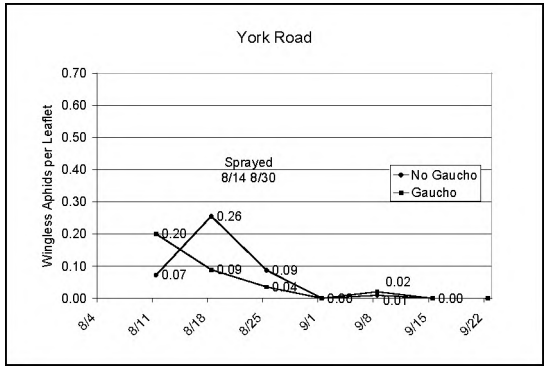




Wingless Aphids / Leaflet







Winged Aphids / Leaflet